UNIVERSITÀ DEGLI STUDI DI PALERMO

DEPARTMENT	Scienze e Tecnologie Biologiche, Chimiche e Farmaceutiche
ACADEMIC YEAR	2023/2024
BACHELOR'S DEGREE (BSC)	BIOLOGICAL SCIENCES
INTEGRATED COURSE	GENERAL AND SYSTEMATIC BOTANY WITH PRACTICE
CODE	15955
MODULES	Yes
NUMBER OF MODULES	2
SCIENTIFIC SECTOR(S)	BIO/02, BIO/01
HEAD PROFESSOR(S)	SALMERI CRISTINA MARIA BERNARDINA — Professore Associato — Univ. di PALERMO BAZAN GIUSEPPE — Professore Associato — Univ. di PALERMO
OTHER PROFESSOR(S)	SALMERI CRISTINA MARIA BERNARDINA — Professore Associato — Univ. di PALERMO BAZAN GIUSEPPE — Professore Associato — Univ. di PALERMO SPADARO VIVIENNE — Professore Associato — Univ. di PALERMO GERACI ANNA — Ricercatore — Univ. di PALERMO
CREDITS	12
PROPAEDEUTICAL SUBJECTS	
MUTUALIZATION	
YEAR	1
TERM (SEMESTER)	2° semester
ATTENDANCE	Not mandatory
EVALUATION	Out of 30
TEACHER OFFICE HOURS	**BAZAN GIUSEPPE** Monday 09:00 19:00 Ricevimento a distanza su Piattaforma Microsoft Teams. Tuesday 09:00 19:00 Ricevimento a distanza su Piattaforma Microsoft Teams. Wednesday 09:00 19:00 Ricevimento a distanza su Piattaforma Microsoft Teams. Thursday 09:00 19:00 Ricevimento a distanza su Piattaforma Microsoft Teams. Friday 09:00 19:00 Ricevimento a distanza su Piattaforma Microsoft Teams. Saturday 09:00 12:00 Ricevimento a distanza su Piattaforma Microsoft Teams. **GERACI ANNA** Wednesday 9:00 11:00 Via archirafi 38, previa prenotazione tramite portale o per email Thursday 9:00 11:00 Via archirafi 38, previa prenotazione tramite portale o per email **SALMERI CRISTINA MARIA BERNARDINA** Tuesday 11:00 13:00 Via Archirafi 38 1° piano, previa prenotazione tramite portale o email docente Wednesday 9:00 10:30 Via Archirafi 38 1° piano, previa prenotazione tramite portale o email docente Thursday 11:00 12:30 Via Archirafi 38 1° piano, previa prenotazione tramite portale o email docente **SPADARO VIVIENNE** Wednesday 11:00 13:00 Sezione di Botanica, via Architravi 38

DOCENTE: Prof. GIUSEPPE BAZAN- *Lettere L-Z*

PREREQUISITES	Basic knowledge of biology
LEARNING OUTCOMES	Knowledge and learning outcomes The student will acquire basic information on plant biology, with special reference to evolutionary and reproductive systems, as well as thorough knowledge of structure and functions of plant cell, and the histology and organography of vascular plants. The student becomes also aware of the basic rules of plant systematics and plant nomenclature, the principles governing plant-environment relationships, the concepts of species and biodiversity, and the basic methods for identifying plants. Ability to apply knowledge and comprehension skills The student will gain basic skills and technique-scientific methods needed to cope with further studies, such as plant physiology and plant ecology, and applied issues on plant biology, thanks to the acquirement of explicit theoretical, methodological and experimental skills. Independent judgment Theoretical tools enabling critical assessment of fundamental concepts related to plant biodiversity and biological evolution will be provided. Basic knowledge to assess and explain experimental investigations and general information on lab safety will be also acquired. Communication skills The student becomes able to explain with proper scientific language the course topics and the topical issues of plant biology. The student will also improve his/her skills of thinking and communicating experimental data, both verbally and practically. Learning ability The Course aims at developing the ability in analyzing plant specimens at different levels, both structural (morpho-anatomical), functional and evolutionary, making possible further studies with high degree of autonomy. To this end, the Course points to trigger student's curiosity and scientific interest towards plant biodiversity and the main relationships with surrounding environment. Activities undertaken in the tutorials involve technical and scientific methods for macro- and microscopic investigations on plant specimens and allow students to practically observe, test and compare what learned from lectures.
ASSESSMENT METHODS	Type of assessment In progress test – Written essay, consisting of n. 6 free answer questions and/or n. 30 multiple-choice questions per module. Test timing over 2 hours. Requested topics are related to the first parts of the program for each module (approximately 1/3 of the program), which will be defined and communicated before the trial. Alternatively, the in-progress test can be an oral examination upon agreement with the Professor. Final exam – Oral examination. Student must answer at least 4 questions about the main program topics, not interested by the intermediate test. Requested topics are: General Botany - Plant tissues,Plant tissues, Plant tissues, Plant Organs (Root, Stem, Leaf), Ontogenetic cycle, Reproductive structures, Report from tutorials. Systematic Botany – Algae, Fungi, Land Plants, both Cryptogams and Seed Plants, Description of plant specimens (from Herbarium collections or living material) One or two additional questions will be placed on the first part of the course program in case of absent, insufficient or less than 24/30 intermediate test, or in case of student's specific request (e.g. unsatisfactory evaluation). Assessment criteria In progress test – Questions are structured to highlight the achieved learning (about 1/3 of the course program) in terms of contents, the logical-analytical skills and the ability to synthesize information, as well as the acquired proper language. Results scored out of 30, rating 0 to 10 for each question. Final oral exam – The student is evaluated for his/her specific knowledge on plant evolutionary biology and phylogenetic relationships among and within the main systematic groups, the levels of learning of course contents, the logical-deductive ability and the proper use of suitable scientific vocabulary. Results scored out of 30. In the case of available in progress test, the final score is the average of marks from both the intermediate essay and the final exam. The final exam is considered to be sufficient, with minimum score 18/30, when student shows at least an overall knowledge on the main issues, being aware of basic paths of plant evolution and phylogenetic role of the primitive and derivative characters. Results are evaluated as excellent, with a score of 30/30, when student shows

	detailed knowledge of the whole program, logical and analytical skills about evolutionary processes which allow him to apply possible cross-links and deductive personal interpretations, using an appropriate scientific vocabulary.
TEACHING METHODS	Lectures and tutorials

DOCENTE: Prof.ssa CRISTINA MARIA BERNARDINA SALMERI- *Lettere A-K*

PREREQUISITES	Basic knowledge of biology
LEARNING OUTCOMES	Knowledge understanding The student will acquire basic information on plant biology, with special reference to evolutionary and reproductive systems, as well as thorough knowledge of structure and functions of plant cell, and the histology and organography of vascular plants. The student becomes also aware of the basic rules of plant systematics and plant nomenclature, the principles governing plant-environment relationships, the concepts of species and biodiversity, and the basic methods for identifying plants. Applying knowledge and understanding The student will gain basic skills and technique-scientific methods needed to cope with further studies, such as plant physiology and plant ecology, and applied issues on plant biology, thanks to the acquirement of explicit theoretical, methodological and experimental skills. Making judgments Theoretical tools enabling critical assessment of fundamental concepts related to plant biodiversity and biological evolution will be provided. Basic knowledge to assess and explain experimental investigations and general information on lab safety will be also acquired. Communication skills The student becomes able to explain with proper scientific language the course topics and the topical issues of plant biology. The student will also improve his/her skills of thinking and communicating experimental data, both verbally and practically. Learning skills The Course aims at developing the ability in analyzing plant specimens at different levels, both structural (morpho-anatomical), functional and evolutionary, making possible further studies with high degree of autonomy. To this end, the Course points to trigger student's curiosity and scientific interest towards plant biodiversity and the main relationships with surrounding environment. Activities undertaken in the tutorials involve technical and scientific methods for macro- and microscopic investigations on plant specimens and allow students to practically observe, test and compare what learned from lectures.
ASSESSMENT METHODS	Type of assessment In progress test – Written essay, consisting of multiple-choice questions and / or at least 3 free answer questions per module. Test timing over 2 hours. Requested topics are related to the first parts of the program for each module (approximately 1/3 of the program), which will be defined and communicated before the trial. Alternatively, the in-progress test can be an oral examination upon agreement with the Professor. Final exam – Oral examination. Student must answer at least 4 questions about the main program topics, not interested by the intermediate test. Requested topics are: General Botany - Plant tissues,Plant tissues, Plant tissues, Plant Organs (Root, Stem, Leaf), Ontogenetic cycle, Reproductive structures, Report from tutorials. Systematic Botany – Algae, Fungi, Land Plants, both Cryptogams and Seed Plants, Description of plant specimens (from Herbarium collections or living material). One or two additional questions will be placed on the first part of the course program in case of absent, insufficient or less than 24/30 intermediate test, or in case of student's specific request (e.g. unsatisfactory evaluation). Assessment criteria In progress test – Questions are structured to highlight the achieved learning (about 1/3 of the course program) in terms of contents, the logical-analytical skills and the ability to synthesize information, as well as the acquired proper language. Results scored out of 30, rating up to max. 10 the section with multiple-choice questions if present. Final oral exam – The student is evaluated for his/her specific knowledge on plant evolutionary biology and phylogenetic relationships among and within the main systematic groups, the levels of learning of course contents, the logical-deductive ability and the proper use of suitable scientific vocabulary. Results scored out of 30. In the case of available in progress test, the final score is the average of marks from both the intermediate essay and the final exam. The final exam is considered to be sufficient, with minimum score 18/30, when student shows at least an overall knowledge on the main issues, being aware of basic paths of plant evolution and phylogenetic role of the primitive and derivative

	characters. Results are evaluated as excellent, with a score of 30/30, when student shows detailed knowledge of the whole program, logical and analytical skills about evolutionary processes which allow him to apply possible cross-links and deductive personal interpretations, using an appropriate scientific vocabulary.
TEACHING METHODS	Lectures and lab practice

MODULE
GENERAL BOTANY WITH PRACTICE

Prof. GIUSEPPE BAZAN - Lettere L-Z, - Lettere L-Z

SUGGESTED BIBLIOGRAPHY

Mauseth J. (2020). Botanica. Fondamenti di Biologia delle piante. 4a Ed., Idelson-Gnocchi. ISBN: 978-8879476980
Mauseth J. (2019). Botany: An Introduction to Plant Biology. 7th Ed., Jones & Bartlett Publisher ISBN: 978-1284157352
Evert R.F. & Eichorn S.E. (2013). La Biologia delle piante di Raven. 7a ed. Zanichelli, Bologna.ISBN: 978-8808175045
Evert R.F. & Eichorn S.E. (2013). Raven Biology of Plants. 8th Edition. W.H. Freeman and Company, NY. ISBN: 978-1464117800
Bell A.D. (1993). La forma delle piante. Guida illustrata alla morfologia delle angiosperme. Zanichelli, Bologna. ISBN: 9788808141927
Arrigoni O. (1973). Biologia Vegetale. Casa Editrice Ambrosiana. ISBN: 9788840800141

AMBIT	50029-Discipline biologiche
INDIVIDUAL STUDY (Hrs)	98
COURSE ACTIVITY (Hrs)	52

EDUCATIONAL OBJECTIVES OF THE MODULE

The module aims to provide students with an understanding of the relationships between the expression of genes and the influence of the environment in plants. This course focuses on analysis of morphology, integrated cellular systems, comparative plant anatomy, ontogenesis and differentiation, function of tissues and organs with its reserves, the totipotency of the cells (Cell flexibility), the biochemistry and the all adaptive mechanisms that represent the cellular responses to environmental stress. The acquired knowledge will also provide students the tools necessary for carrying out activities such as the identification of vegetative and reproductive organs and reserve substances in higher plants (Gymnosperms and Angiosperms).
The study of biological processes and plant development will also be approached through the application of microscopic and histological staining techniques.

SYLLABUS

Hrs	Frontal teaching
6	Introduction to Botany. Structural organization of the plants. Structural levels and methods of nutrition. Biochemistry of plants (Carbohydrates, Lipids, Proteins, Nucleic Acids, Secondary Metabolites). Specific aspects of the plant cell and ultrastructure. Prokaryotic and eukaryotic. Plant genomes.
6	Plastids (classification, ultrastructure and function). Vacuoles (tonoplast, ultrastructure and function). water equilibrium. Reserves. The cell wall (ultrastructure and function. Metabolism). Modifications of the cell wall.
4	The cell cycle. Growth and cell division. Ontogenetic cycle of the plant. Determination, differentiation and function of tissues and organs. Totipotency of the cells. The different degrees of structural organization.
6	Meristematic tissues. meristems and unlimited growth. Permanent embryogenesis. Adult tissues or definitive (fundamental tissues, vascular tissues, tegumentary tissues). The organs of Cormophytes.
6	Root: structure and functions. Anatomy of the root. Structure of the root apex. Primary structure. Secondary structure. Modifications and adaptations of the root to the environment. Root symbiosis.
6	Stem: structure and functions. Anatomy of the stem. Structure of the shoot apex. Primary structure. Secondary structure. Modifications and adaptations to the environment of the stem.
6	Leaf: morphology and anatomy of the leaf. Modifications and adaptations of the leaf to the environment. Reproductive structures. The seed.

Hrs	Workshops
12	The tutorials consist of practical activities carried out in the laboratory that will cover the following topics: methods of study of plant cells; microscopic, histochemical and cytochemical methods; preparation and staining of fresh herbal preparations; interpretation of microscopic images and anatomical diagrams; observation and interpretation of cyto-histo-anatomical characters in taxonomy and in relation to the environment.

MODULE
GENERAL BOTANY WITH PRACTICE

Prof.ssa ANNA GERACI - Lettere A-K, - Lettere A-K

SUGGESTED BIBLIOGRAPHY

Mauseth J. (2020). Botanica. Fondamenti di Biologia delle piante. 4a Ed., Idelson-Gnocchi. ISBN: 978-8879476980
Mauseth J. (2019). Botany: An Introduction to Plant Biology. 7th Ed., Jones & Bartlett Publisher ISBN: 978-1284157352
Evert R.F. & Eichorn S.E. (2013). La Biologia delle piante di Raven. 7a ed. Zanichelli, Bologna.ISBN: 978-8808175045
Evert R.F. & Eichorn S.E. (2013). Raven Biology of Plants. 8th Edition. W.H. Freeman and Company, NY. ISBN: 978-1464117800
Bell A.D. (1993). La forma delle piante. Guida illustrata alla morfologia delle angiosperme. Zanichelli, Bologna. ISBN: 9788808141927
Arrigoni O. (1973). Biologia Vegetale. Casa Editrice Ambrosiana. ISBN: 9788840800141

AMBIT	50029-Discipline biologiche
INDIVIDUAL STUDY (Hrs)	98
COURSE ACTIVITY (Hrs)	52

EDUCATIONAL OBJECTIVES OF THE MODULE

The module aims to provide students with an understanding of the relationships between the expression of genes and the influence of the environment in plants. This course focuses on analysis of morphology, integrated cellular systems, comparative plant anatomy, ontogenesis and differentiation, function of tissues and organs with its reserves, the totipotency of the cells (Cell flexibility), the biochemistry and the all adaptive mechanisms that represent the cellular responses to environmental stress. The acquired knowledge will also provide students the tools necessary for carrying out activities such as the identification of vegetative and reproductive organs and reserve substances in higher plants (Gymnosperms and Angiosperms).
The study of biological processes and plant development will also be approached through the application of microscopic and histological staining techniques.

SYLLABUS

Hrs	Frontal teaching
6	Introduction to Botany. Structural organization of the plants. Structural levels and methods of nutrition. Biochemistry of plants (Carbohydrates, Lipids, Proteins, Nucleic Acids, Secondary Metabolites). Specific aspects of the plant cell and ultrastructure. Prokaryotic and eukaryotic. Plant genomes.
6	Plastids (classification, ultrastructure and function). Vacuoles (tonoplast, ultrastructure and function). water equilibrium. Reserves. The cell wall (ultrastructure and function. Metabolism). Modifications of the cell wall .
4	The cell cycle. Growth and cell division. Ontogenetic cycle of the plant. Determination, differentiation and function of tissues and organs. Totipotency of the cells. The different degrees of structural organization.
6	Meristematic tissues. meristems and unlimited growth. Permanent embryogenesis. Adult tissues or definitive (fundamental tissues, vascular tissues, tegumentary tissues). The organs of Cormophytes.
6	Root: structure and functions. Anatomy of the root. Structure of the root apex. Primary structure. Secondary structure. Modifications and adaptations of the root to the environment. Root symbiosis
6	Stem: structure and functions. Anatomy of the stem. Structure of the shoot apex. Primary structure. Secondary structure. Modifications and adaptations to the environment of the stem.
6	Leaf: morphology and anatomy of the leaf. Modifications and adaptations of the leaf to the environment. Reproductive structures. The seed.

Hrs	Workshops
12	The tutorials consist of practical activities carried out in the laboratory that will cover the following topics: methods of study of plant cells; microscopic, histochemical and cytochemical methods; preparation and staining of fresh herbal preparations; interpretation of microscopic images and anatomical diagrams; observation and interpretation of cyto-histo-anatomical characters in taxonomy and in relation to the environment.

MODULE
SYSTEMATIC BOTANY WITH PRACTICE

Prof.ssa CRISTINA MARIA BERNARDINA SALMERI - Lettere A-K, - Lettere A-K

SUGGESTED BIBLIOGRAPHY

MAUSETH J. (2019). Botanica. Fondamenti di Biologia delle piante. 4a Edizione, Idelson-Gnocchi. ISBN: 887947698X (utilizzabile anche 3a edizione 2014 ISBN: 9788879475822)
Mauseth J. (2019). Botany: An Introduction to Plant Biology. 7th Ed., Jones & Bartlett Publisher. ISBN: 9781284157352

EVERT R.F. & EICHORN S.E. (2013). La Biologia delle piante di Raven. 7a ed. Zanichelli, Bologna. ISBN: 9788808175045
Evert R.F. & Eichorn S.E. (2013). Raven Biology of Plants. 8th Edition. W.H. Freeman and Company, NY. ISBN: 9781429219617

GEROLA F.M. (1998). Biologia Vegetale. Sistematica filogenetica. Terza Ed., UTET. ISBN: 8802051097 (per specifici argomenti, su indicazione del docente / for single topics suggested by the teacher)

AMBIT	10665-Attività formative affini o integrative
INDIVIDUAL STUDY (Hrs)	98
COURSE ACTIVITY (Hrs)	52

EDUCATIONAL OBJECTIVES OF THE MODULE

This module aims to provide essential information needed to know and understand plant diversification and evolution, ranging from the simplest organisms to the most complex ones. To this respect, lessons deal with classification, identification and nomenclature models of main plant systematic groups, for each one providing the most relevant morphological and functional features, biological and ecological requirements, adaptive and reproductive strategies. The course particularly emphasizes those structural and functional modifications among different groups, from simple prokaryotic algae to the most specialized land plants, representing evolutionary milestones and allowing the identification and distinction among systematic ranks. A section is devoted to study body features, life styles, nutrition modes and reproduction systems of fungi, yet placed in a distinct kingdom. The course also gives basic information to understand how environmental factors can affect plant growth and distribution, inducing precise adaptive strategies, as well as fundamentals of plant biodiversity and plant landscape features. Tutorials deal with the recognition of main land plant groups with special reference to representative families and genera of seed plants using identification keys and lecture notes on the topic.

SYLLABUS

Hrs	Frontal teaching
4	Aims and contents of the module. Definition of Taxonomy and Phylogenetics. Plant classification systems. Systematic ranks and plant nomenclature. Materials and methods in plant taxonomy; living collections (Botanic Gardens) and exsiccata (Herbaria).
7	Plant reproductive systems: description, meaning and models of asexual and sexual reproduction and sporogony. Plant biological cycles: types of life cycles and reproductive cycles. Elements of plant sexuality (hermaphroditism, monoecism, dioecism). Concept of species and plant speciation.
1	Prokaryotes: features, biology and ecology with specific topics on Cyanobacteria (blue-green algae)
6	Eukaryotic algae: distinctive features, Systematics, representative biological cycles and basic ecology of main lineages (red algae, heterokonts, green algae)
2	The origin of land plants: environmental pressures, ancestors and assumptions, plant adaptation to land life. Evidence of early land plants (Rhyniophyta).
3	Non-vascular cryptogams (Bryophytes in broad sense): body and reproductive features, biological cycle, Systematics of extant lineages (mosses, liverworts, hornworts).
3	Vascular cryptogams (Tracheophyta): vegetative and reproductive characters, bilogical cycle. Isospory and heterospory. Distinctive features and Systematics of main lineages: Lycophytines (clubmosses), and Polypodiophytines (Equisetales ie. horstails, Psilotales i.e. whisk ferns, Polypodiales and Salviniales, i.e. leptosporangiate ferns).
5	Seed plants: vegetative characteristics, pollen, ovule, seed. Gymnosperms: vegetative and reproductive structures. Biological cycle. Extinct transitional lineages: Progymnosperms and Pteridosperms. Characteristics and Systematics of extant groups (Cycadales, Ginkgoales, Pinales, Gnetales).
5	Angiosperms: flowers and inflorescences. Pollination systems and double fertilization. Fruits and infructescences. Seed dispersion modes. Angiosperm Systematics (APG IV); distinctive characters of monocots and eudicots.
4	Fungi: main morphological features, nutrition, reproduction, distinctive biological cycle and ecological requirements of major systematic groups (Oomycota, Zygomycota, Ascomycota e Basidiomycota). Lichens: elements of morphology, reproductive modes and ecology.

Hrs	Workshops
12	Lab practice: examination and identification of principal systematic groups of land plants, also by using morphological traits and dichotomous analytic keys (Seed plants). Realization of herbarium collections. Didactic visits at the Botanic garden and Herbarium Mediterraneum.

MODULE
SYSTEMATIC BOTANY WITH PRACTICE

Prof.ssa VIVIENNE SPADARO - Lettere L-Z, - Lettere L-Z

SUGGESTED BIBLIOGRAPHY

EVERT R.F. & EICHORN S.E. (2013). La Biologia delle piante di Raven. 7a ed. Zanichelli, Bologna. ISBN: 9788808175045
MAUSETH J.D. (2020). Botanica. Fondamenti di Biologia delle piante. 4a Ed., Idelson-Gnocchi. SBN: 887947698X
GEROLA F.M. (2006). Biologia Vegetale. Sistematica filogenetica. 3 Ed., UTET. ISBN: 8802051097

AMBIT	10665-Attività formative affini o integrative
INDIVIDUAL STUDY (Hrs)	98
COURSE ACTIVITY (Hrs)	52

EDUCATIONAL OBJECTIVES OF THE MODULE

This module aims to provide essential information needed to know and understand plant diversification and evolution, ranging from the simplest organisms to the most complex ones. To this respect, lessons deal with classification, identification and nomenclature models of main plant systematic groups, for each one providing the most relevant morphological and functional features, biological and ecological requirements, adaptive and reproductive strategies. The course particularly emphasizes those structural and functional modifications among different groups, from simple prokaryotic algae to the most specialized land plants, representing evolutionary milestones and allowing the identification and distinction among systematic ranks. A section is devoted to study body features, life styles, nutrition modes and reproduction systems of fungi. The course also gives basic information to understand how environmental factors can affect plant growth and distribution, inducing precise adaptive strategies, as well as fundamentals of plant biodiversity and plant landscape features. Tutorials deal with the recognition of main land plant groups with special reference to representative families and genera of seed plants using identification keys and lecture notes on the topic.

SYLLABUS

Hrs	Frontal teaching
4	Aims and contents of the module. Definition of Taxonomy and Phylogenetics. Plant classification systems. Systematic ranks and plant nomenclature. Materials and methods in plant taxonomy; living collections (Botanic Gardens) and exsiccata (Herbaria).
7	Plant reproductive systems: description, meaning and models of asexual and sexual reproduction and sporogony. Plant biological cycles: types of life cycles and reproductive cycles. Elements of plant sexuality (hermaphroditism, monoecism, dioecism). Concept of species and plant speciation.
1	Prokaryotes: features, biology and ecology with specific topics on Cyanobacteria.
6	Algae: distinctive features, Systematics, representative biological cycles and basic ecology of main lineages (red algae, heterokonts, green algae)
4	Fungi: main morphological features, nutrition, reproduction, distinctive biological cycle and ecological requirements of major systematic groups (Zygomycota, Ascomycota e Basidiomycota). Lichens: elements of morphology, reproductive modes and ecology.
2	The origin of land plants: environmental pressures, ancestors and assumptions, plant adaptation to land life. Evidence of early land plants (Rhyniophyta).
3	Non-vascular cryptogams (Bryophytes in broad sense): body and reproductive features, biological cycle, Systematics of extant lineages (mosses, liverworts, hornworts).
3	Vascular cryptogams: vegetative and reproductive characters, bilogical cycle. Isospory and heterospory. Distinctive features and Systematics of main lineages: Lycophytes (clubmosses) and Monilophytes (Equisetales ie. horstails, Psilotales i.e. whisk ferns, Polipodiales and Salviniales, i.e. leptosporangiate ferns).
5	Seed plants: vegetative characteristics, pollen, ovule, seed. Gymnosperms: vegetative and reproductive structures. Biological cycle. Extinct transitional lineages: Progymnosperms and Pteridosperms. Characteristics and Systematics of extant groups (Cycadales, Ginkgoales, Pinales, Gnetales).
5	Angiosperms: flowers and inflorescences. Pollination systems and double fertilization. Fruits and infructescences. Seed dispersion modes. Angiosperm Systematics (APG IV); distinctive characters of monocots and eudicots.

Hrs	Workshops
12	The following activities will be carried out in the laboratory. Examination and identification of principal systematic groups of land plants, also by using morphological traits and dichotomous analytic keys (Seed plants). Realization of herbarium collections. Didactic visits at the Botanic garden - Herbarium Mediterraneum.